GLIAL ANOMALY IN MALFORMED BRAIN OF FETUS OF MOUSE CAUSED BY IRRADIATION : ITS POSSIBLE RELATIONS TO DEVELOPMENT OF GLIOMA OF THE BRAIN IN INFANCY AND CHILDHOOD

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By

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INTRODUCTORY NOTES

It has long been conceived that gliomas of the human brain, particularly of the cerebellum, develop on the base of undifferentiated glial cell rests (Cushing, Raaf and Kernohan, and Gloeus and Kulenbeck). Cerebellar vermis, in particular its posterior half, the floor of the 4th ventricle, pons and quadrigeminal body are in general considered to be the sites of predilection for occurrence of gliomas in children under the age of ten years. And gliomas occurring in man around the age of adolescence are liable to develop in the 3rd ventricle, pineal body, optic tract, thalamus, basal ganglia and septum pellucidum. There are some who are of the opinion that gliomas in adult man of the rhinencephalon, of the "Umschlagsstelle" of the lateral ventricle in the fetal period and of the callosal body, gliomas of diffuse nature and multiple gliomas have definitely something to do with the developmental anomaly (Ostertag).

Shimada from our laboratory studied in 1954 the development of glial cells in various parts of the fetal brains of differnt fetal months and observed that the sites where immature glial cells normally persisted roughly corresponded with the seats of predilection of gliomas. He noticed also that heterotopic cell rests were not infrequently found also in the same locations.

As the brain in fetal period undergoes considerably prompt and complicated development, it would reasonably be conjectured that fetal brain tissues may readily show abnormal changes when exogeneous factors effective for tissue malformation are inflicted.

Having treated the mother mouse on the 8th day of gestation with trypan blue (Shirota) and urethane (Yamazaki), respectively, Shirota and Yamazaki studied independently on the developmental anomaly of glial cells in brain of both the fetuses of normal appearance and of malformed fetuses from that same mother, on the 19th day of gestation, and some correlation was made between the locations of glial tissue anomaly with the seats of predilection for occurrence of gliomas of the brain in human children and infants.

In the present study, x-ray irradiation, which has for a fairly long time been known to be effective for giving rise to tissue malformation, was applied to gravid

mice, according to the method of MURAKAMI. WILSON et al. in 1951 treated rat embryos on the 9th day of gestation with Roentgen irradiation and found that a neoplasia would not infrequently but transiently be induced from the neural tube in abnormal locations. Similar researches as were done by SHIROTA and YAMAZAKI were made by the present author in various parts of the brain of malformed fetuses as well as of fetuses of grossly normal appearance from the one and the same mother mouse which underwent Roentgen irradiation.

MATERIALS AND METHODS OF THE EXPERIMENT

A. Materials of the Experiment

MURAKAMI roentgenized the mouse, on its 8th gravid day, with a dose of 25-150 r to the whole body and disclosed that malformation was to be found in the central nervous system. He also pointed out that x-ray irradiation with a larger dosage might give rise to malformations not only in the central nervous system but also in the mesodermal system, while with a lesser dosage malformation appeared in the central nervous system only (pseudoencephaly, hydrocephalus of slight degree, cerebral herniation and the like, deformation of the spinal cord) and was absent in the mesodermal system.

According to this method of MURAKAMI, doses of 130-39 r (in air) were given at a single exposure to the whole body of mice of hybrid strain, on the 8th day of gestation. The beam was produced under the following factors : 160KvP. 3 ma, and 0.6 mm Cu+0.5 mm Al added filter. Half-value-layer was 0.76 mm Cu. The target object, each of the mice, was kept in a shallow box, the distance was 30 cm and the duration of exposure varied from 3 to 10 minutes.

On the 19th day of gestation, i.e., one day prior to parturition, the mouse was laparotomized and the fetuses were operatively delivered. Some fetuses had a bulging out (Fig. 1) on the vault like encephalocele (Fig. 3) or pseudencephaly (Fig. 2), evidently revealing typical malformation of the central nervous system. Some others

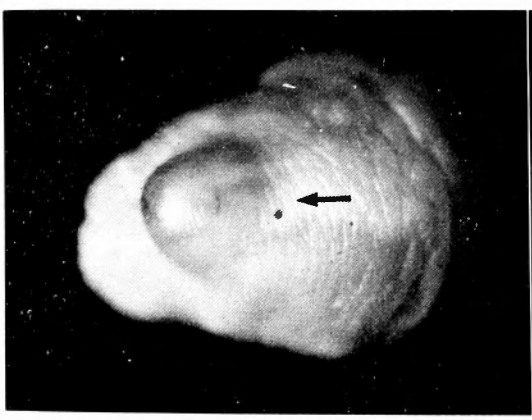

Fig. 1 A bulging out of the parietal region (photographed from above the skull).

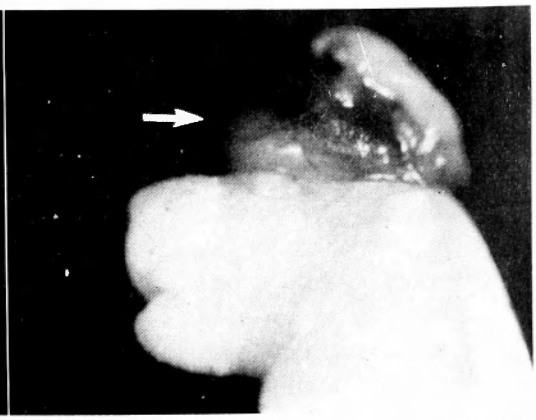

Fig. 2 Pseudencephaly (photo taken from a side of the head).

showed subcutaneous haemorrhagic dots on the scalp and the rest appeared quite normal. The brains of the fetuses (10 with encephalocele and 40 with normal appearance) were fixed in 10% neutralized formalin solution.

B. Methods of the Experiment

For the staining, PENFIELD's silver carbonate method, modification II was used in the great majority of cases. The tissue was saturated with gelatine and frozen sections of the brain as a whole were made, largely in frontal sections, but partly in sagittal or horizontal planes. For the contrast, the microscopic specimens made by the author's colleagues, Drs. SHIROTA and YAMAZAKI, of the brain of normal fetuses were available.

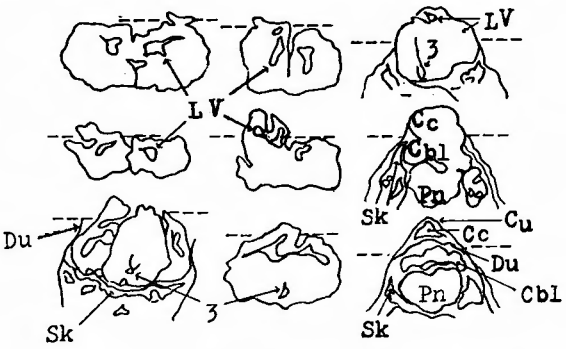

Fig. 3 Drawing of encephaloceles, frontal section in various parts. Bulging out on the head is indicated by the part above each dotted line. LV.···lateral ventricle, 3.···third ventricle,
Cc··· quadrigeminal body, Cbl··· cerebellum, Pn ···pons, Cu ···cutis, Du ···dura, and Sk ··· skull.

RESULTS OF THE EXPERIMENT

A) Brain with Encephalocele (Fig. 3)

In the cases with malformation of slight degree, the cerebrum on one side, occasionally together with the ventricle, bulged out, being covered by the dura mater and the skin (Fig. 1). In case the malformation was pronounced, not only the cerebrum but also the quadrigeminal body was protruded, both being deprived of

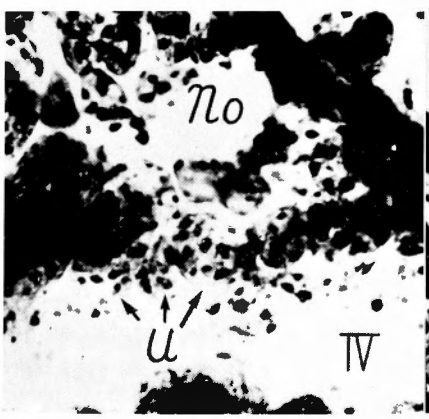

Fig. 4 Undifferentiated apolar cell (U) in the nodulus of normal fetus of mouse on its 19th day of gestation. IV···4th ventricle, and No···cerebellar nodulus. Sagittal section ; × 900.

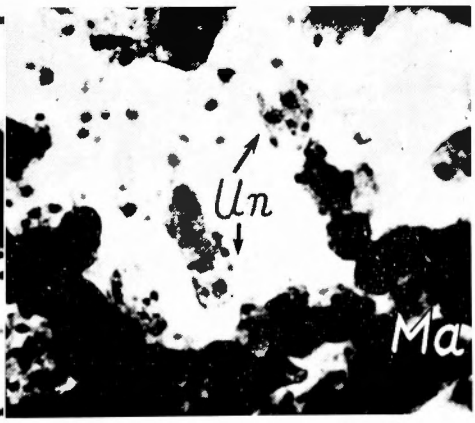

Fig. 5 Transitional cell (Un) between undifferentiated apolar cell and apolar neuroblast in the nodulus of normal fetus of mouse on its 19th day of gestation. Ma ···matrix of the roof of the 4th ventricle. Sagittal section ; × 900.

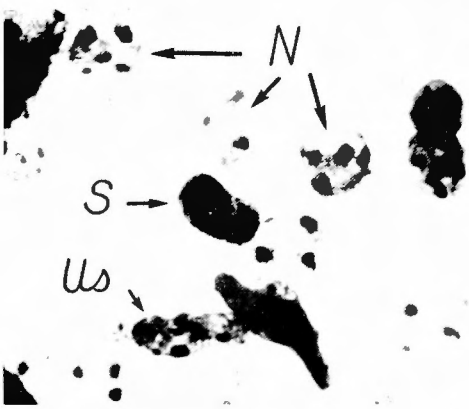

Fig. 6 Apolar neuroblast (N) and apolar spongioblast (S) in the nodulus of normal fetus of mouse, 19 days old. Us···transitional cell between undifferentiated apolar cell and apolar spongioblast. Sagittal section ; ×900.

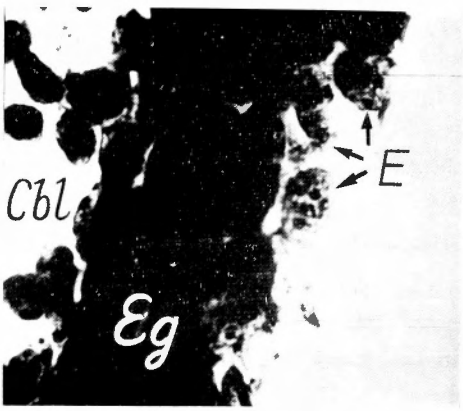

Fig. 7 Immature cell (E) in the immediate subpial tissue of the cerebellum of 19-day-old normal fetus of mouse. This cell is ellipsoid or elongated in shape and resembles undifferentiated apolar cell. Eg···external granular layer, and Cbl···cerebellum. Sagittal section ; ×900.

the overlying dura mater and covered merely by the skin. In some of them, the brain was lacking in any covering and completely exposed (Fig. 2). Furthermore, more or less deformity was liable to occur in the whole ventricular system in such cases (Fig. 3).

Histologically, changes around the ventricular system were conspicuous but cell proliferation beneath the pial membrane was also noticed. Classification of immature cells in the present experiment was the same as was used by SHIMADA and SHIROTA (Figs. 4-7).

I. Rhombencephalon and Mesencephalon

Medulla oblongata and pons : It was remarkable to observe in one case spindle-shaped cluster of elongated apolar cells which were evidently argentophilic and found alongside the blood vessels in the posterior part of the floor of the 4th ventricle, near the taenia chorioidea rhombencephali (Fig. 8). In another case, argentophilic apolar elements aggregated in layers were observed in the basal portion of the medulla oblongata, on the ventral side of the olivary nucleus and adjacent to the pia mater (Fig. 9). In some other cases, irregular proliferation of the ependyma and the subependymal matrix was a prominent feature in the depth of the sulcus medianus at the rostral part of the floor of the 4th ventricle. In still some other cases, considerable growth of apolar elements was observed at the taenia chorioidea rhombencephali.

Cerebellum : Abnormal clusters of immature cells were found predominantly in the white matter near the posterior and lateral medullary velum originating from the rhombic lip. In one case, conglomerates of immature cells largely apolar spongioblasts with scattered apolar neuroblasts, were observed in the region close to the ependyma of the caudal part of the roof of the 4th ventricle (Fig. 10). In

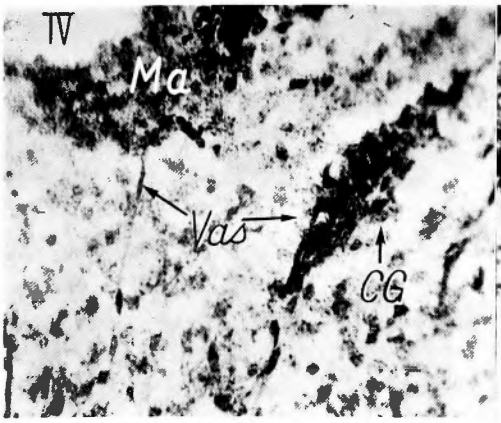

Fig. 8 Abnormal immature cell group(CG), in the posterior portion of the floor of the 4th ventricle, composed of the same argentophilic apolar elongated cell as is found in the abnormal immature cell cluster in Fig. 2. Surrounding the CG are visible many apolar elements shown in Figs. 5 and 6. IV···ventricle, Ma···matrix of the floor of the 4 th ventricle, and Vas···blood vessel. Sagittal section ; ×400.

Fig. 9 Immature cell group (CG) in layer adjoining to the pia mater on the ventral surface of the medulla oblongata. In the immediate subpial region are found cells resembling the immature cells shown in Fig. 7. On the inner side of such cells are present numerous apolar spongioblasts but apolar neuroblasts are also intermingled. Pia···pia mater, and Olv···olivary nucleus. Frontal section ; ×400.

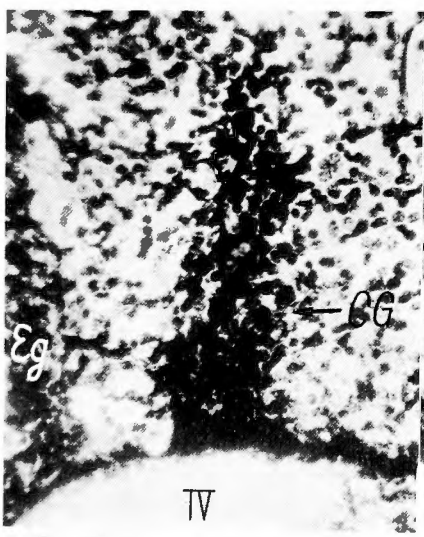

Fig. 10 Immature cell group (CG) of subependymal type, in the latero-caudal part of the left cerebellum, composed principally of apolar spongioblasts and admixed apolar neuroblasts. IV···4th ventricle, Eg···external granular layer. Frontal section ; ×400.

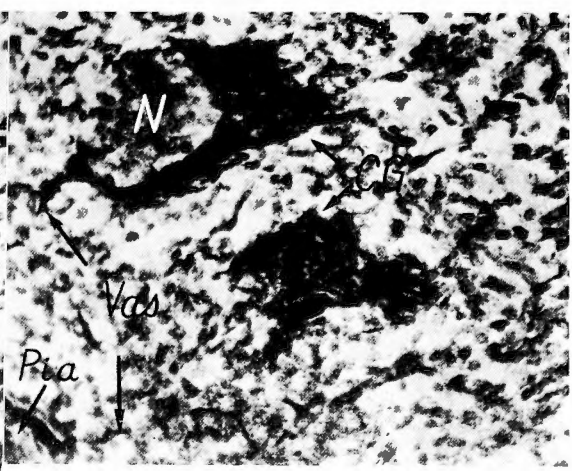

Fig. 11 Heterotopic cell rests (CG) presumably of cortical type in the latero-caudal part of the left cerebellum. The constituent cell, markedly argentophilic, apolar and elongated, resembles the immature cell in the immediate subpial tissue of the cerebellum as shown in Fig. 7. N···cell group composed largely of apolar neuroblasts, Pia···pia mater, and Vas···blood vessel. Frontal section ; ×400.

another case, on the other hand, argentophilic and elongated apolar cell accumulations were seen along the vessels coming from the pial membrane and adjacent to the clusters of apolar neuroblasts which appeared vesicular and bright (Fig. 11).

Occasionally, cell groups composed of apolar and polar spongioblasts and neuroblasts were present along the blood vessels. In other few cases, the external granular layer proliferated irregularly.

Mesencephalon : In the protruded midbrain, which only had a single covering of the skin, the normal cell alignment was lost, the blood vessels showed proliferation and there was a tendency to gliosis (Fig. 12).

Even in those cases which revealed little changes grossly in the midbrain, deformity of the mesencephalic aqueduct was often evidenced. For instance, subependymal cells occasionally projected globiformly out into the aqueduct lumen through the defect of the ependymal layer of the aqueduct (Fig. 13). On other occasions, the lumen of the aqueduct was not patent at all. In one case, ependymal

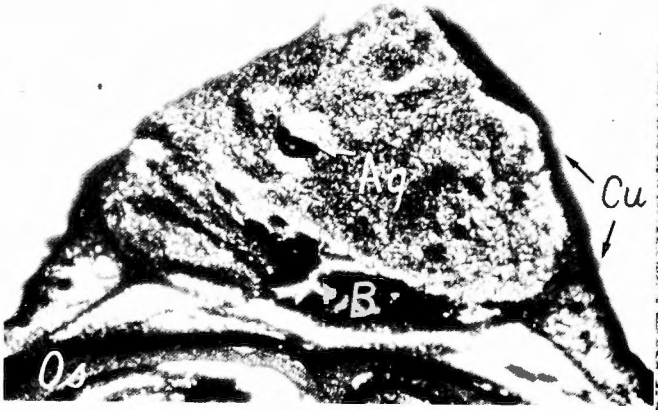

Fig. 12 The protruded midbrain with its single covering skin. Aq···residual aqueduct, and B···haemorrhage. Cu···skin. Frontal section at the posterior part ; ×20

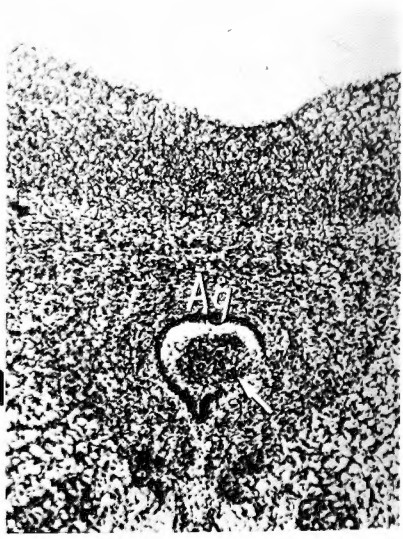

Fig. 13 Abnormal proliferation of the matrix into the lumen of the aqueduct through a defect of the ependymal layer of the mesencephalic aqueduct indicated by arrow. Aq··· mesencephalic aqueduct. Frontal section ; ×100

cell rests in tubular arrangement were found in the subependymal zone of the roof of the aqueduct.

II Prosencephalon

3rd ventricle : Malformation of the ventricle due to developmental disturbance of both the ependymal and subependymal layers was an outstanding finding. Lack of the lumen of the ventricle at the part antero-cranial to the massa intermedia was, in particular, a frequent observation. In one instance, cells in the ependymal layer had abnormally proliferated and appeared as markedly argentophilic apolar elements which in some places obliterated the ventricular lumen (Fig. 14). In another case, cells of the matrix had formed nodular conglomerates around the

interventricular foramina and under the callosal body. In addition, tissue anomalies were found in the following areas : Abnormal fungiform growth of the matrix cells protruding into the ventricle through defect of the ependyma in the part posterior to the massa intermedia ; small globiform cluster (Fig. 15) of apolar elements in the subpial tissue adjacent to the optic chiasma ; cell group composed predominatingly of apolar spongioblasts along the blood vessel located near the tip of the 3rd ventricle ; and small cluster of small round cells of glial nature situated lateral to the mammillary body around which immature cell rests are ordinarily to be found in normal fetus.

Lateral ventricle : In the case in which protrusion of the lateral ventricle was concomitantly present, the changes were in general advanced. Remarkable to note in those cases were irregular proliferations of the ependymal and subependymal layer.

Fig. 14 Obliteration of the 3rd ventricle at the part posterior to the massa intermedia. CG···small globiform cluster of markedly argentophilic apolar elements, and Ep···ventricular ependyma, and Ⅲ···3rd ventricle. Frontal section of the diencephalon ; ×100

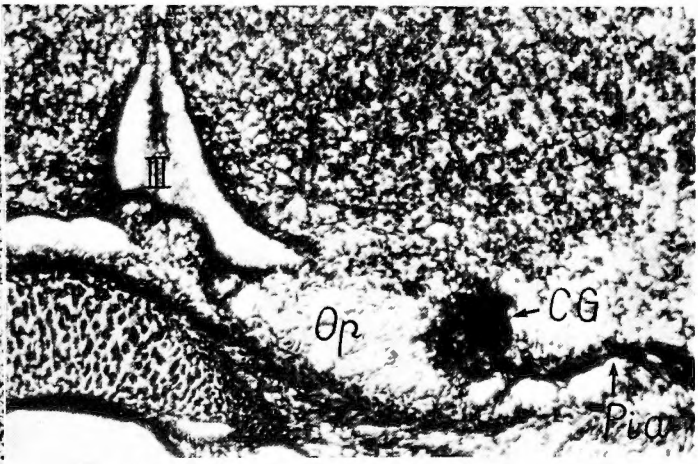

Fig. 15 Abnormal cell group(CG), in the subpial region adjoining to the optic chiasma, composed largely of markedly argentophilic apolar elements resembling those shown in Figs. 5 (Un) and 6 (Us). Pia···pia mater, Ⅲ···3rd ventricle, and Op···right optic tract. Frontal section ; ×200.

It was often disclosed that cells of the subependymal layer protruded out into the ventricular cavity through defect of the ependymal lining or immature cells around the deformed ventricle were displaced into the white matter of the brain (Fig. 16). In the case with the ventricle only slightly malformed, conglomerated cells, forming rosette-like tubules, were likewise discovered as heterotopic cell rests in the vicinity of ganglionic ridge (Ganglienhügel) and hippocampus (Fig. 17). Also, clusters of immature cells resembling matrix cells were occasionally seen alongside the blood vessels in the neighborhood of ganglionic ridge and internal capsule (Fig. 18).

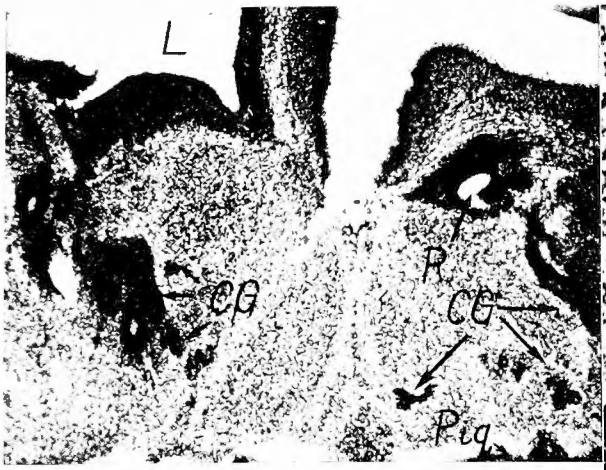

Fig. 16 Periventricular immature cells displaced in the medullary substance (CG) due to deformation of the ventricle. R···right lateral ventricle which became conspicuously small in size, L···dilated left lateral ventricle—note the encephalocele, and Pia···pia mater. Frontal section of the frontal region ; ×40.

Fig. 17 Rosette-like heterotopic cell-rests (CG), in the vicinity of ganglionic ridge, which are presumed to be the displaced ependymal layer. Frontal section ; ×200.

Fig. 18 Heterotopic cell rest(CG), in the lateral portion of the left internal capsule, composed predominantly of apolar spongioblasts. CI···left capsula interna, Vas···blood vessel, and Co···cortex in the left lateroventral part. Frontal section ; ×200.

Cortex and marginal zone : Little changes were microscopically noticed in the cortex, even in the protruded region. In a few cases, clusters of abnormal cells, mostly of neuroblastic type, were found in the temporal region. In one case, on the other hand, abnormal clusters of apolar cell elements, immature and strongly argentophilic, were found in the immediate subpial tissue of the antero-basal part of the cerebral hemisphere or along the blood vessels. In another case, furthermore, cluster of immature apolar cell elements was seen in the subpial tissue of the

hippocampal fimbriae.

Rhinencephalon : Deformation of the rhinencephalic ventricle resulting from proliferation of matrix cells was present. Occasionally, formation of nodular cluster of neuroblasts was evidenced in the medio-ventral part.

B) Brain with No Gross Malformation

More or less hydrocephalus was present in the great majority of cases. Histopathologically, considerable changes were found also in this group of cases.

I. Rhombencephalon and Mesencephalon

Medulla oblongata and pons : In the depth of the sulcus, normally present on the mid sagittal line of the floor of the 4th ventricle, ependymal cells were at times uucovered to have proliferated. And around this sulcus, apolar and/or polar spongioblasts and neuroblasts were occasionally seen to form small cell clusters. In a few cases, the tissue of the tela chorioidea appeared somewhat thickened when contrasted with the normal one.

Cerebellum : In the dorso-caudal part of the roof of the 4th ventricle, the nodulus, there were sometimes visible globiform clusters of polar spongioblasts and neuroblasts and in the perivascular zone of the vessels runing through the central white matter were occasionally found funicular clusters of apolar spongioblasts and

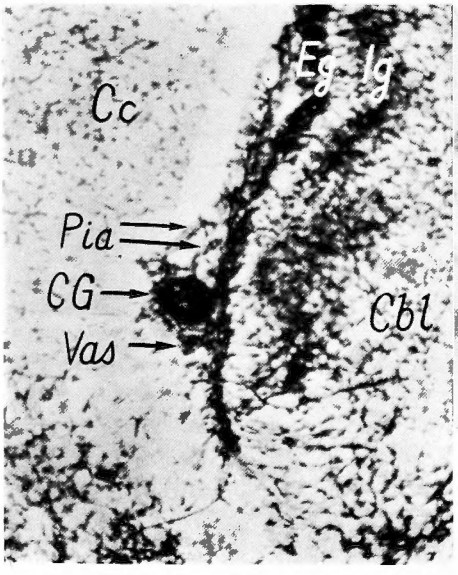

Fig. 19 Small globiform growth (CG) in the upper part of the transitional zone between the quadrigeminal body and the cerebellum. Cc···inferior colliculus, Cbl···Cerebellum, Pia···leptomeninges, Eg···external granular layer, Ig···internal granular layer, and Vas···blood vessel. Sagittal section ; ×100.

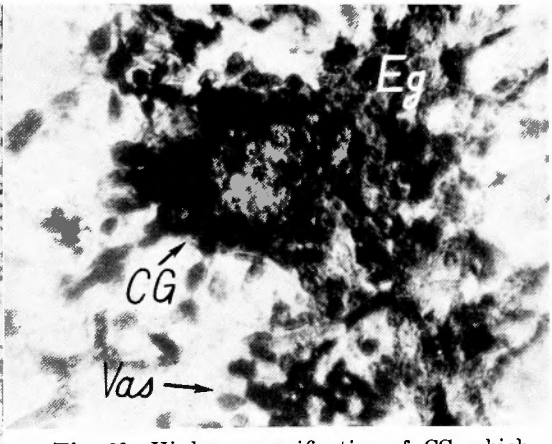

Fig. 20 Higher magnification of CG which is shown in the foregoing figure (Fig. 20). This growth is in contact with the external granular layer and composed mainly of the cells shown in Fig. 7. Vas···blood vessel. Sagittal section ; ×500.

neuroblasts. In several cases, apolar and bipolar spongioblasts and neuroblasts aggregated in the perivascular zone in the latero-caudal part of the white matter, near the lateral medullary velum, although those aggregates can also be seen in some normal fetuses.

Around the anterior medullary velum : Small globiform growth of apolar elements was found, in one case, in the pial membrane situated between the caudal part of the quadrigeminal body and the cerebellum (Figs. 19 and 20). In other few cases, the cells of the external granular layer at the foremost tip of the cerebellum seemed to have more proliferated as compared with those of normal fetus.

Mesencephalon : In the peri-aqueductal substance subependymally and perivascularly were found now and then abnormal cell groups. These groups were composed of apolar and polar spongioblasts or neuroblasts.

II. Prosencephalon

Around the 3rd Ventricle : Partial obliteration or narrowing of the ventricular cavity by clusters of apolar or polar cell elements was occasionally disclosed, although the finding may not necessarily be considered as abnormal. In the thalamus and its neighborhood, perivascular cell accumulation composed of apolar spongioblasts and neuroblasts was frequently seen. However, this finding, too, seems to be not paticularly abnormal. In one case, rosette-like formation consisting of small, round and argentophilic cells, presumably apolar spongioblasts, was observed in the part anterior to the red nucleus (Fig. 21). In some other cases, clusters of apolar cells were seen in the subpial tissue close to the optic chiasma, although it was not clear whether they were of glial origin or not. In still some other cases, similar clusters were found beneath the pial folds in the transitional zone between the base of the diencephalon and the temporal lobe. Since in these regions are to be found also in normal fetus accumulations of similar cells, the finding may not be considered to be pathologic.

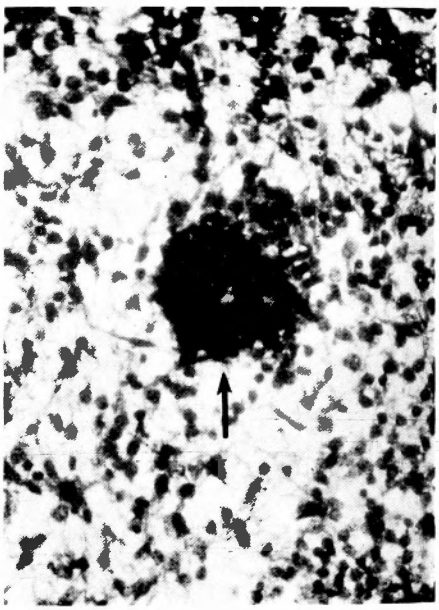

Fig. 21 Rosette-like formation indicated by arrow in the part anterior to the red nucleus. Markedly argentophilic, apolar, small and round cells are seen to aggregate closely together. Frontal section at the posterior part of the diencephalon on the left side ; ×400.

Lateral Ventricle : Remarkable change, such as malformation of the ventricle or of the matrix, which was seen in the cases associated with encephalocele, was absent. But hydrocephalus was at times confirmed. In those cases in which hydrocephalic changes were severe the number of the cells of the matrix and the medullary substance was found to have decreased remarkably (Fig. 22).

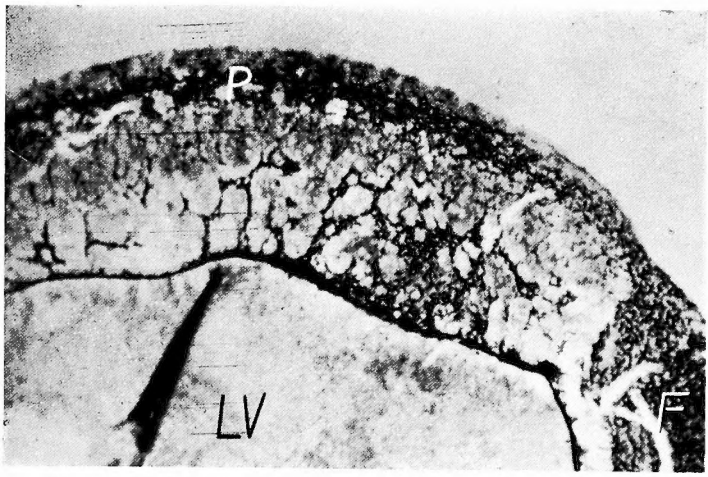

Fig. 22 Pronounced hydrocephalus of the lateral ventricle. Cells of the matrix and medullary substance are irregularly decreased in number. LV···lateral ventricle, F···frontal region, and P···parietal region. Sagittal section ; ×80.

Medullary Substance : It was sometimes noted that the streams of polar cell elements radiating from the matrix to the subcortex became irregular or apolar spongioblasts and neuroblasts gathered together along the vessels adjacent to the matrix. In one instance, matrix cells grew in small isolated clusters perivascularly around the internal capsule(Fig. 23).

Funicular clusters principally of apolar spongioblasts were frequently seen in the perivascular zone inside the cortex (Fig. 24). In one instance, small islets of argentophilic apolar and small round cells were found in the subcortex of the frontal region. In the transitional zone between the frontal lobe and the rhinencephalon, pseudo-rosettes made of apolar or polar neuroblasts and spongioblasts were observed (Fig. 25).

Rhinencephalon : In a part of the cortex, nodular cell groups suggesting gliosis were occasionally seen.

The more the quantity of the x-ray given the more the changes as described above.

COMMENT

Various malformations, not only in gross appearance but also histological, were caused by Roentgen irradiation of the fetus of mouse at the early stage of its gestation.

Wilson and others studied the developmental anomaly with abnormal cell growths in the brain of fetuses of rats caused by x-ray irradiation and grouped them in several types as follows : "polypoid" growth which protrudes in the brain cavity ; "rosette" within the wall of the neural tube, or intramural growth; "attached" growth projecting from the outer or marginal surface of neural tube into the surrounding mesenchyme ; "isolated" growth which is lying free within the

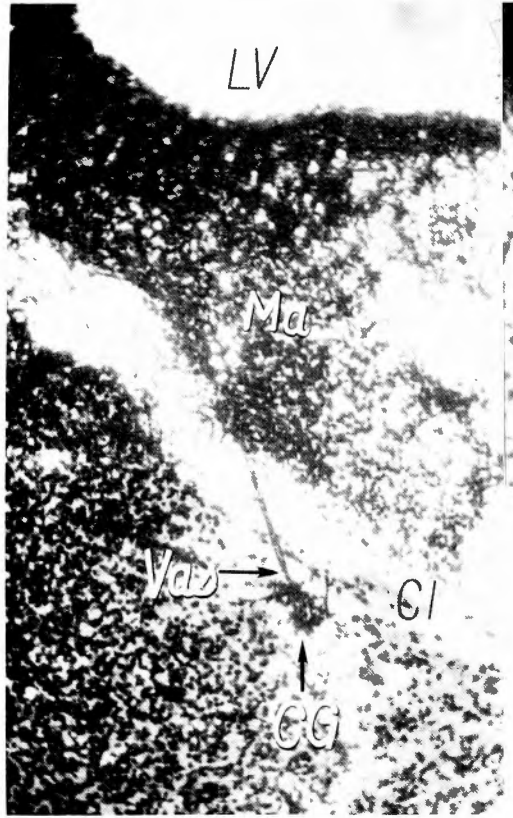

Fig. 23 Heterotopic cell rest (CG) in the lateral portion of the left internal capsula. The apolar elements which constitute the cell rest resemble very much the cells of the surrounding matrix. Vas · blood vessel hanging over like a bridge between the cell rest and the matrix, Ma · matrix, and Lv · left lateral ventricle. Horizontal section ; × 100.

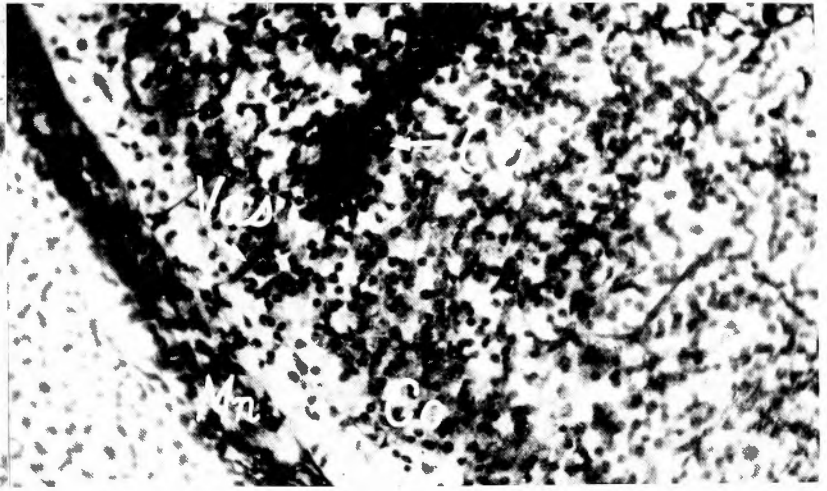

Fig. 24 Funicular cluster (CG), composed principally of apolar spongioblasts and extending from the cortex to the subcortex, in the latero-ventral portion of the left cerebral hemisphere. Mn · meninges encephali, Co · cortex, and Vas · blood vessel. Frontal section ; × 200.

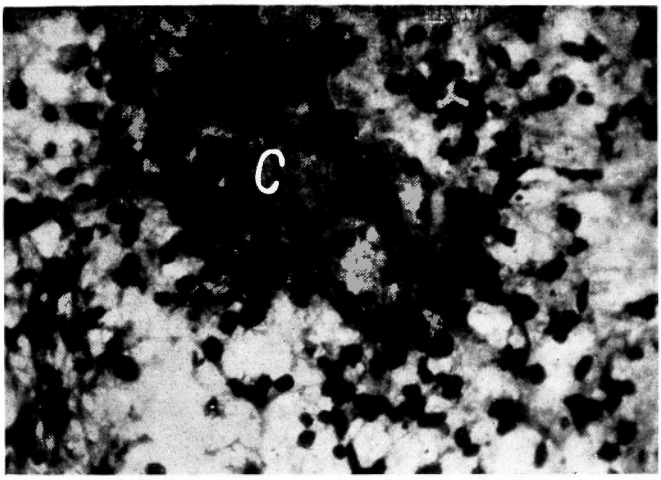

Fig. 25 Pseudorosette in the transitional zone between the frontal region and the rhinencephalon. The central part underwent degeneration is encircled by apolar spongioblasts and neuroblasts which again are surrounded by polar spongioblasts and neuroblasts. C···astructural central part. Horizontal section ; ×600.

mesenchyme ; and "cutaneous" growth which is in contact with the ectoderm covering the head. Such neoplastic growths, though considerably different in time among each types, gradually disappear or become inactive or even regressive, as the gestation proceeds until to its end, parturition.

In the experiment undertaken here (with the fetus of mouse at its 19th day of gestation), the abnormal cell clusters are found similarly to the findings of WILSON. That is to say, the fungiform proliferation of the matrix in the mesencephalic aqueduct (Fig. 13) and the 3rd ventricle, posterior to the massa intermedia, corresponds with the "polypoid" growth ; rosette-like cell aggregate found in the surrounding part of the red nucleus (Fig. 21) and in the transitional zone between the frontal lobe and the rhinencephalon (Fig. 25) with the "rosette"; and the small cell cluster (Figs. 20 and 21) in the pial membrane between the quadrigeminal body and the cerebellum with the "attached" growth.

In comparison with the findings obtained from the experiments of SHIROTA and YAMAZAKI, the brain of the fetus of mouse, treated with trypan blue and urethane, respectively, there was general consistency in the histological observations, although the gross appearances were varying. The gross malformations of the brain in the cases treated with trypan blue were open dysrrhaphy and pseudoencephaly principally affecting the mesencephalon, while those with x-ray irradiation were mainly unilateral encephalocele covered by the skin(maybe due to the small amount of x-ray given).

Histological study in the present experiment likewise revealed, as the experiments with trypan blue and urethane, persistence or displacement of immature glial cells predominantly alongside the ventricular system. It should, however, be mentioned that,. while the microscopical changes in trypan blue animals were, as the macroscopical ones were, mostly found in the parts caudal to the midbrain, those of the roentgenized

animals were outstanding rather in the cerebrum.

With the same staining method, we performed another series of histological study in human malformed fetuses. But definite changes could not be indicated, as the number of the cases was too small and the months of pregnancy were diverse. It was, therefore, hesitated to compare the results in human fetuses with those of the present experiment with mice. Only the following histologic abnormality may be mentioned in passing : The immature cell group in layer found in mouse in the ventral portion of the rhombencephalon and in contact with the pial membrane (Fig. 9) seemed to be somewhat resembling the layered immature cell clusters adjoining to the proliferated pia-like tissue on the ventral surface of the pons in human malformed fetus. The polypoid growth of the external granular layer, projectiong into the leptomeninges between the quadrigeminal body and the cerebellum (Figs. 19 and 20) in mouse seems to be essentially analogous with the proliferation of the pial(?) tissue in the continuity with the anterior tip of external granular layer of the human malformed fetus and with excrescences of the external granular layer in its foremost border region. And the clusters of elongated cells in the white matter of the latero-caudal part of the cerebellum (Fig. 11) in mouse simulated those found in the central white matter of the cerebellum in the human malformed fetus.

Although the abnormal cell groups found in mouse did not show any tendency to tumor formation, it was interesting to note some similarity between these localizations and the seats of predilection for occurrence of glioma in human children.

In the white matter of the cerebellum, near the posterior and lateral medullary velum, immature cell conglomerates largely of apolar spongioblasts and partly of apolar neuroblasts and funicular cell clusters of elongated cells resembling cells of the external granular layer were observed. These parts seem to correspond with the posterior medullary velum and its neighboring white matter of the cerebellum where glioma of children is liable to develop.

Abnormally displaced clusters of cells resembling matrix of the lateral ventricle were frequently present in the corpus striatum and its surrounding structures. This part seems to correspond with the so-called striato-thalamic junction of GLOBUS and KULENBECK, who are of the view that the fetal cell rests may have something to do with the tumors of the spongioneuroblastic series in that same region.

Generally speaking, the abnormal cell groups found in the present experiment are apt to appear the more frequently and numerously, the more pronounced the gross malformation and the nearer to the seat of the malformation.

SUMMARY AND CONCLUSION

In the aim to clarify the relationship between the developmental anomaly of glial system in the fetal period and the gliomas, the brain of the fetus of mouse roentgenized was stained with silver impregnation and histological anomaly of glial cells was examined. The x-ray irradiation was performed according to the MURAKAMI's method in hybrid mother mice on the 8 th day of gestation and the fetuses were

taken out on the 19th day of gestation. The malformations thus produced were largely encephaloceles. Examinations were carried out in these malformed brains as well as those with grossly normal appearance. The main histological abnormality was the frequent finding of immature cell clusters around the ventricular system and also in the subpial tissues. The abnormality may be a feature of the disturbed development of the brain as seen from the angle of the glial cells. And it was presumed that those regions correspondingly indicate the seats of predilection for occurrence of human gliomas.

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和文抄録

レ線照射マウス胎仔の奇形脳に於ける組織異常

——人間小児脳グリオームの発生より見たる——

京都大学医学部外科学教室第1講座（指導：荒木千里教授）
山添善朗

脳グリアの胎生期発育異常とグリオームとの関係を伺う目的からレ線処理を行つたマウス胎仔脳について，鍍銀染色を行い，グリア系細胞の組織学的異常を検査した．レ線照射は，村上法に従つて妊娠第8日の雑系母マウスに行い，胎仔は第19日に取り出した．生じた奇形は主としてencephalocele であつた．検査はこの奇形を有する胎仔及び外見的異常を有しない胎仔の脳各部位について行つた．組織学的な異常は，主として脳室系に沿つて，又屢々軟膜下に幼若細胞集団として認められた．これらは脳の発育障害の一面が，グリアの成熟に表われたものと思われる．唯その好発部位は人間の脳グリオームの好発部位に可成り一致していると考えられた．